British Columbia versus Canadian Forest Products: Estimating Nonmarket Damage to an Ecologically Sensitive Area

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Background

In 1992, a fire destroyed approximately 1500 ha of forest in the Prince George Forest District of British Columbia (B.C.). Two hundred and fifty hectares of this area were classified as an Environmentally Sensitive Area, which means the trees are to be excluded from harvesting. The area borders a stream that supplies local drinking water and supports fish populations.

As a result of the fire, the Province of British Columbia sued Canadian Forest Products Ltd. to recover damages for the lost resources. In order to establish damages, the B.C. Court of Appeal needed to estimate the economic value of the protected trees. Justice Hall ruled that it would be unfair to assign full market value for trees never intended for market, so he awarded one-third of the market price to the B.C. government. This damage amount was appealed to the Supreme Court of Canada. The case was heard in October 2003, and a decision is expected within a year.

This paper provides a rationale for why market prices alone underestimate the value of forests and hence, damage to them, by providing background information under the following topics: nonmarket valuation techniques, use of nonmarket valuation to support Environment Canada policies, relevant court cases, and nonmarket benefits of forests.

Nonmarket Valuation Techniques

Economists recognize that people value and have preferences for environmental improvements, and are willing to pay for bettering their environment. As an example, people in Toronto would be willing to pay for cleaner air and less smog, while someone whose lake was closed by water pollution would be willing to pay to have it re-opened. However, environmental amenities such as cleaner air and water are not traded in markets, and so these changes in well-being or societal welfare[1] are not easily measured. As a result, a series of special techniques, called ‘nonmarket valuation’, have been developed by economists over the past two decades to estimate or infer these values.

[1] A special branch of economics called welfare economics provides a theoretical basis for nonmarket valuation techniques.

The effort to develop these techniques has been considerable; thousands of scientific articles have been published on the subject in the past two decades.[2] Some of these techniques use surveys to ask people directly how much they would be willing to pay for improvements to the environment. This class of techniques is referred to as ‘stated preference’, and includes contingent valuation and conjoint analysis.

Another class of techniques, referred to as ‘revealed preference’, infer values by observing market prices associated with environmental amenities. For example, peoples’ willingness to pay for urban woodlands can be inferred through higher property prices of houses adjacent to these sites. This is called the ‘hedonic price method’. Another technique known as the ‘travel cost method’ infers values for recreational activities such as hiking, fishing, or swimming by estimating a demand curve based on the costs of traveling to these sites.

Finally, to determine the value of an environmental asset, such as water or forest resources, an approach called ‘Total Economic Value’ has been developed. For this approach, the first step is to determine the various services (ecological and economic) provided by an amenity, such as drinking, recreation, and navigation services for water resources, or the commercial, carbon storage, and erosion prevention functions of forests. The next step is to use both nonmarket techniques and prices to estimate values of these service flows, and then to sum them to estimate the total value.

When the asset value of nature’s services are estimated this way, economists refer to the resource as ‘natural capital’ because of the similarity of these services to those generated by human-made capital, such as machinery. At Statistics Canada, the concept of natural capital is a central theme used to support the development of their new green or environmental accounts, which are gradually being integrated into the national accounts. As a component of this work, Environment Canada has partnered with Statistics Canada to estimate the value of Canada’s water resources by using a natural capital framework.

Nonmarket Valuation and Environment Canada Policies

At Environment Canada, nonmarket valuation has been used to support a variety of policies over the past decade. Most notable is their use to support clean air regulations for sulfur, nitrous oxide, particulate matter, and numerous other air pollutants, some of which are related to climate change policies. Nonmarket valuation is used to estimate the improvements or benefits for cost-benefit analysis studies, which are required by the Treasury Board for all new regulations.

To develop permanent capacity in this area, Environment Canada built the Air Quality Valuation Model, a computer/spreadsheet model that can quickly estimate the benefits of new clean air policies. It uses the Total Economic Value approach to sum the various benefits of cleaner air, such as reduced mortality, and improved health conditions, such as lower rates of asthma and bronchitis in the Canadian population. A complementary model developed by the

[2]See Garrod and Willis (1999) for an overview of these techniques.

department, called the Environment Valuation Reference Inventory (http://www.evri.ca), has summaries of approximately 1000 studies that can be used for benefits transfer, a valuation technique that facilitates the use of values from previous studies so quick responses can be made to policy needs. Additionally, the department periodically commissions studies such as that conducted by Abt Associates (1995) which used contingent valuation to estimate the benefits of a new regulation on dry cleaning solvents.

Use of Nonmarket Valuation in the Courts

Along with government policy, nonmarket valuation has been used to estimate damage claims for court settlements. The most common claims are for oil spills, and to date, much of this litigation has occurred in the United States, although there have been a few cases in Canada. The most famous of these cases was the Exxon Valdez oil spill, which occurred in 1989 in Prince William Sound off the coast of Alaska. A study commissioned by the U.S. National Oceanic and Atmospheric Administration (NOAA) estimated the value of damages at U.S.$3.0 billion (1994) for passive uses[3] related to the spill (Table 1). This figure was used for an out-of-court settlement of U.S.$1.2 billion. Other settlements for oil spills that have been made in the United States and Canada are presented in Table 1.

Table 1. Damages and settlements for selected oil spills[a] (1994 U.S. dollars).

Name of tanker, location, and date	*Estimated damages*	*Countries affected*	*Settlement*
Nestucca, Washington coast, 1988	$162 million, all values, mainly passive uses	Canada and the U.S.	$10.5 million
Tenyo Maru, Juan de Fuca Strait, 1991	$3–$22 million extractive,[b] nonextractive, and passive uses	Canada and the U.S.	$9 million
Exxon Valdez, Prince William Sound, 1989	$3.0 billion passive use	U.S.	$1.2 billion
Arco Anchorage, Port Angeles Harbor, 1985	$39,000 response cost	U.S.	$416,000

[a]Adapted from RCG/Hagler Bailly Inc. (1995).
[b]Extractive uses are uses such as fishing or hunting that take something away from the environment. By comparison, nonextractive uses such as hiking and wildlife viewing do not remove anything from a resource.

More recently, the Government of Canada used the court system to seek damages from a pesticide spill in Prince Edward Island. Environment Canada economists and scientists collaborated on a study that estimated damages related to the loss of 2500 brook trout due to runoff of pesticide from a potato farm (MacDonald et al. 2000). For the study, demand-curve

[3]Passive uses are nonuse values, such as knowledge of continued existence of an environmental resource or the need to leave a resource to future generations.

analysis was used to estimate the lost service flows from closing a recreational fishery. Combined with other services, the total market and nonmarket damages were estimated at between $37,000 and $39,000 (1999 Canadian dollars).

Nonmarket Valuation of Forests

Many of the techniques and concepts discussed in this paper have been used and adapted to value forests both for their timber and nontimber benefits in various countries including Canada, Mexico, and the United Kingdom (Garrod and Willis 1997; Boxall et al. 1999; Langner and Swanson 1999; Condon 2000; Gardner Pinfold Consulting 2002). Generally, the approach taken, such as that used by Pearce (1999) or Adger et al. (1994), is to develop a list of uses and functions within a Total Economic Value framework (Table 2). The nonmarket and priced values are then estimated using techniques listed in Table 2.

In addition to their use for commercial timber, forests generate a wide variety of service flows. Carbon storage or sequestration, as a preventative measure against climate change, is an important function that has the largest nontimber value in almost all studies. Pearce (1999) suggests these values can be estimated by assigning an economic value for every tonne of carbon released to the environment, and then determining the net carbon released when a forest is converted to another use through clearing or burning.

Other important nontimber values include ecological functions provided by forests such as soil erosion prevention and watershed protection. Deforestation exposes forest soils, and quantifiable damages can be estimated from accelerated water runoff leading to localized flooding and reduced hydrological cycling and recharge of groundwater and watercourses.

Other nontimber values include the recreational use of forests for activities such as hiking and nature viewing, the use of various nontimber products such as nuts, berries, and wood for firewood, and the use of forests for hunting by subsistence cultures such as northern aboriginal peoples in Canada (Haener et al. 2001). Pearce (1999) suggests it is these nontimber values, not the current supply of commercial timber, that are becoming increasingly scarce on a global scale. So, to not include nontimber values in an evaluation of a forest would underestimate its benefits to society.

Table 2. List of functions and uses of forests.

Functions and uses	*Description*	*Methodology*
Timber values	The value of timber harvested for commercial uses such as paper or home construction	Market price of timber estimated per hectare
Nontimber values	All functions of forests not related to commercial uses	
a) Carbon storage	Carbon sequestration functions that help to dampen effects of climate change	A value per tonne of damage is estimated using benefits transfer[a]
b) Recreation	Hiking, nature viewing and other outdoor activities	Variety of techniques such as travel cost method and contingent valuation
c) Ecological functions	Watershed protection; erosion and sedimentation control; maintenance of biodiversity	Contingent valuation
d) Nontimber forest products	A variety of plant species used mostly for local purposes such as fuel wood, nuts, berries, and pharmaceuticals	Market prices or approximation of those prices
Passive values	Values stemming from knowledge of the existence of forests	Contingent valuation

[a]See the Environmental Valuation Reference Inventory (http://www.evri.ca/) for an explanation of the benefits transfer methodology.

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